

# All-Metal Dual-Polarized W-band Patch Element for Phased Array Antenna Applications

Completed Technology Project (2012 - 2013)



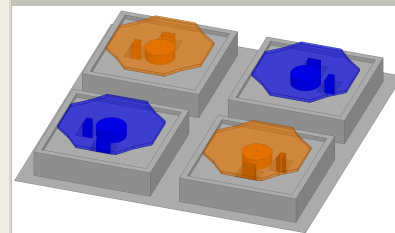
## Project Introduction

The objective of this work is to design and demonstrate an interlaced patch array aperture for transmission and reception of dual-polarized radar signals at 94 GHz (W-band). The antenna elements will be constructed as metal patches and will contain no dielectric. The interlaced transmit / receive array configuration eliminates front-end losses at each element, increasing performance and simplifying transmit / receive electronics.

Metal patches were developed for the Juno Microwave radiometer instrument at P-band and L-band. The absence of dielectric in the metal patch design obviated issues with static discharge in the Jupiter orbital environment. However, metal patches readily scale to operation at other frequencies, and have excellent loss performance at W-band. Moreover, metal patches can be fabricated accurately using photo-lithographically defined microfabrication techniques that are dielectric free. The metal patch antenna elements that will be developed in this work are intended for use in an array-fed reflector system that is scanned in azimuth through the use of phase shifters in transmit and receive MMICs. This technology will support W-band cloud radar for the Aerosol/Cloud/Ecosystem (ACE) decadal survey mission, as well as other millimeter-wave applications. The focus of this work is to develop the antenna elements and associated feed networks; active electronics will be developed separately. The work will result in the design, fabrication, and testing of a 2x2 element array, termed a unit cell. A much larger feed array will be formed as the linear concatenation of these unit cells in subsequent development work. The unit cell (illustrated below) developed in this work incorporates all of the salient features that are critical to constructing larger scanning arrays, including the microfabricated feed network and the capability to predict scan performance. As a key part of the verification approach, a waveguide adapter fixture to measure network performance and element patterns of the unit cell device.

## Anticipated Benefits

N/A



Project Image All-Metal Dual-Polarized W-band Patch Element for Phased Array Antenna Applications

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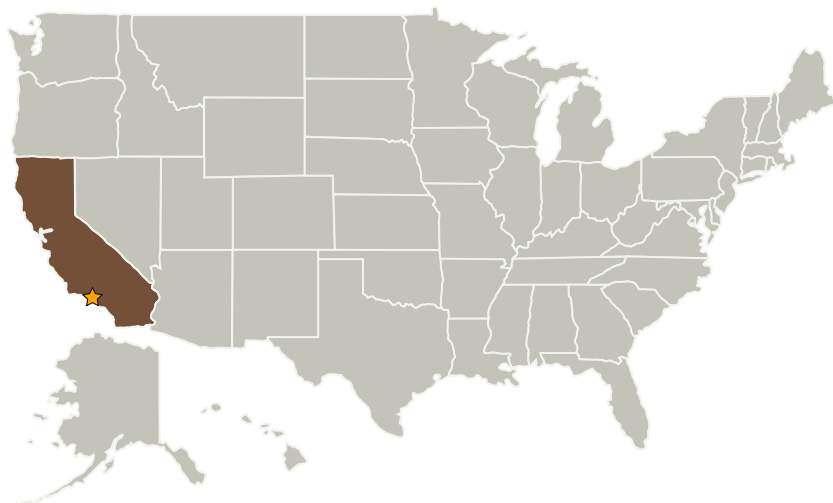
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Jet Propulsion Laboratory (JPL)	Lead Organization	NASA Center	Pasadena, California

### Primary U.S. Work Locations

California

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

### Responsible Program:

Center Innovation Fund: JPL CIF

## Project Management

### Program Director:

Michael R Lapointe

### Program Manager:

Fred Y Hadaegh

### Project Manager:

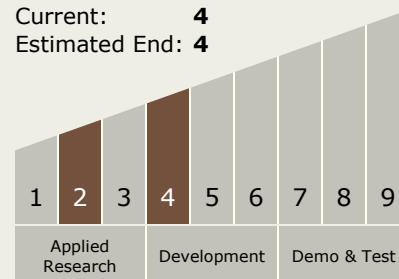
Jonas Zmuidzinas

### Principal Investigator:

Neil F Chamberlain

## Technology Maturity (TRL)

Start: 2  
Current: 4  
Estimated End: 4

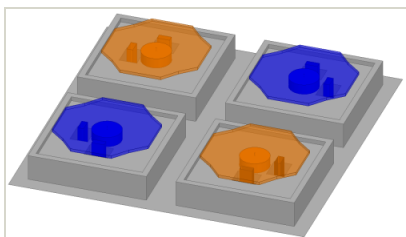


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## Images



### 71.png

Project Image All-Metal Dual-Polarized W-band Patch Element for Phased Array Antenna Applications (<https://techport.nasa.gov/image/1165>)

## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.2 Observatories
    - └ TX08.2.2 Structures and Antennas